First Demonstration of Pulsar Positioning System (PPS)

Completed Technology Project (2015 - 2016)

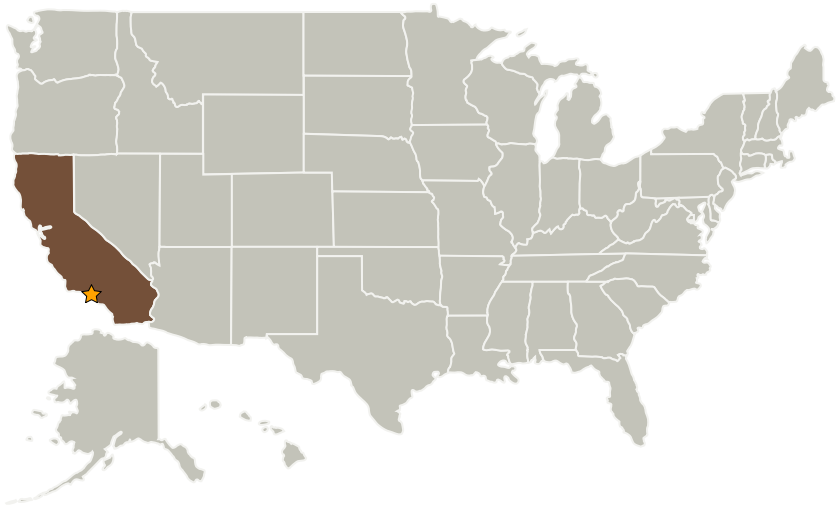
Project Introduction

Carry out first time demonstration of a global positioning system using pulsars as celestial clocks. Pulsars are rotating neutron stars that emit clock-like pulses across the electromagnetic spectrum. A subclass of pulsars rotating ~1000 times per second, the so called millisecond pulsars (MSPs) have fantastic precision and are targeted for precision tests of GR, and detection of GW. The same pulsars can also be used as navigation beacons to obtain the position and velocity of spacecraft's in an almost autonomous fashion. Among the ~2300 pulsars detected so far, ~250 belong to the MSP family, mostly detected in radio wavelength.

Anticipated Benefits

Potential Applications: GPS augmentation, Deep space autonomous navigation, Conditioning of space clocks. Follow-on Options: JPL's R&TD program to further develop the concept and solve technical challenges, Reach out to DARPA for ground-based applications, NASA STMD's Game Changing program, Ground-based segment for NICER.

Primary U.S. Work Locations and Key Partners



First Demonstration of Pulsar Positioning System (PPS)

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Center Innovation Fund: JPL CIF

Center Innovation Fund: JPL CIF

First Demonstration of Pulsar Positioning System (PPS)

Completed Technology Project (2015 - 2016)

Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
University of Southern California(USC)	Supporting Organization	Academia	Los Angeles, California

Primary U.S. Work Locations
California

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html

Project Management

Program Director:

Michael R Lapointe

Program Manager:

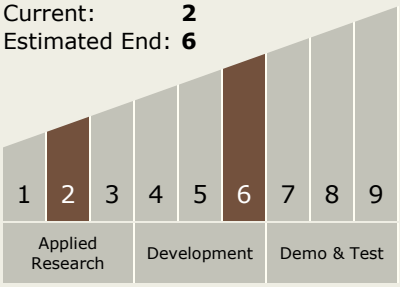
Fred Y Hadaegh

Principal Investigator:

Walid A Majid

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **6**



Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.4 Network Provided Position, Navigation, and Timing
    - TX05.4.2 Revolutionary Position, Navigation, and Timing Technologies